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GAS ABSTRACTS

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CONTENTS

1. Gas Industry 173

2. Appliances, Domestic 173

3. Combustion: Commercial and Industrial Furnaces 175

4. Gasification: Carbonization: Natural Gas Substitutes 176

5. Natural Gas and Natural Gas Condensates 178
   A. Production and Processing:
   B. Compression and Transmission:
   C. Distribution

6. Petroleum and Synthetic Liquid Fuels 184

7. Analytical Methods and Tests 186

8. General and Physical Chemistry 188

9. Organic Chemistry: Petrochemicals 189

10. Chemical Engineering 190

11. Process Equipment and Instrumentation 191

12. Materials of Construction: Corrosion 191

13. New Books 192

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1. GAS INDUSTRY

Future Gas Supply

Tippy, W. B. SOME ASPECTS OF GAS SUPPLY. Amer. Gas Assoc. Exec. Conf. Paper, Colo. Springs (1956) June 21; *Publ. Utilities Fortn.*, 58, 183-87, Aug. 2 (1956).

Views of the American Gas Association Committee on Economics as to how and when to speed up the research program on a supply of "Synthetic Natural Gas" are presented. The question of supply has become important in (1) financing of distribution and pipeline companies on a basis of credit and survival (2) providing a ceiling for rising field prices of gas to meet end-use competitive prices and (3) actual physical need for a supplemental supply of gas in view of rising demand and uncertain recoverable reserves of natural gas (and petroleum), and competition between forms of energy. The total U.S. energy situation, concerning reserves and consumption is discussed (in rounded figures) and a need for synthetic natural gas is indicated, increasing after 1965. Gas industry leaders are asked to decide on a program (proposed to P.A.R. in Feb. 1956) to (1) complete experimental work to select the most suitable process (synthesis gas-methanation or direct coal hydrogenation) for major pilot development; (2) complete by Jan. 1, 1958, at least one design for a full-scale gas production plant; (3) speed the decision enabling research by enlarged allocations to 1956 program. (See also: Amer. Gas Assoc., Opertg Sect. Paper CEP-56-8, Phila, May 16, 1956).

O. P. Brysch

Gas Engineers

Famularo, J. J. DO WE GET OUR SHARE OF GRADUATES? *Amer. Gas Assoc. Monthly*, 38, 6-8 (1956) July-August.

A survey of 23 companies showed the average starting salary paid beginning engineers in 1956 was $388, which is some $20 less than for Institute of Gas Technology graduates placed at the same time. This and the higher rates of terminations for engineers than other employees indicate that the inducement and environment to attract the best engineers still may not be present.

R. T. Ellington

Information Service

Skolnick, H. PLANNING AN R & D INFORMATION CENTER. *Research and Eng.*, 11, 26-29 (1956) July.

A research and development information center can act as a bridge over which external and internal scientific knowledge and facts are brought to and received from the staff. Its function should be to accumulate and make available a collection of primary and secondary information sources to the staff to read and study as it wishes and to communicate desired information to it as needed. Some of the operations and services which might be included in such a center are described.

C. A. Simms

Research Management

Swearingen, J. S. ESTIMATING RESEARCH COST. *Petrol. Refiner*, 35, 124-6 (1956) June.

The author discusses the steps into which a research effort can be broken and the fact that the cost of these steps can be estimated with reasonable accuracy. This makes it possible to appraise proposed programs and select the most advantageous one. He concludes that a program does not deserve to be considered research until it has passed this test.

R. T. Ellington

2. APPLIANCES

Air Conditioning

Hall, C. E. GAS AIR CONDITIONING STRIDES AHEAD. *Butane-Propane News*, 18, 35-39 (1956) July.

The author reviews reasons for the tremendous expenditures for research and development of electric conditioning systems and the status of the heat pump. Detailed accounts are given of the development work being carried out by the Coleman Company and field experience on their engine driven compression unit.

R. T. Ellington

Kelley, G. SMALL COMMERCIAL AIR CONDITIONING: A DEALER'S OPPORTUNITY. *Butane-Propane News*, 18, 51, 53, 55, 57 (1956) July.

In the excitement of entering the residential air conditioning field, the far more lucrative commercial market should not be overlooked.

Commercial climate control is no longer limited to theaters and restaurants. Several preparatory steps should be taken before entering the field, however, and these are outlined here.

Author's Abstract

Mann, M. HOT-AIR ENGINE MAY COOL YOUR HOUSE. *Popular Science*, 108-111, 244 (1956) July.

The work of Professor O. A, Carnahan on increasing the efficiency of the hot air or external combustion engine is described briefly. This work is being done in cooperation with the Coleman Company's efforts to develop the engine as a gas-fired prime mover for air conditioners.

R. T. Ellington

Burners

Cissell, W. M. (assigned to W. M. Cissell Manufacturing Co., Inc.) GAS BURNER. U. S. 2,755,850 (1956) July 24.

Dornback, W. H., Jr. GAS BURNER. U. S. 2,754,894 (1956) July 17.

Dow, W. M. and Porter, B. (assigned to United Gas Corp.) TAPERED BORE GAS BURNERS. U. S. 2,755,851 (1956) July 24.

Hershey, L. E. (assigned to Borg-Warner Corp.) SINGLE PORT GAS BURNER AND REMOVABLE FLAME DEFLECTOR. U. S. 2,754,895 (1956) July 17.

Wildermann, O. (assigned to Ensign Ribbon Burners, Inc.) DUAL BAND TYPE GAS BURNER WITH CROSS-OVER FLAME CONNECTION. U. S. 2,747,658 (1956) May 29.

Controls and Ignition

Andrews, G. E. and Aubert, F. B. (assigned to Detroit Controls Corp.) CONTROL DEVICES. U. S. 2,755,852 (1956) July 24.

Fleury, J. E. (assigned to Detroit Controls Corp.) ELECTRIC IGNITER. U. S. 2,753,930 (1956) July 10.

Gerstmayr, L. A. (assigned to W. Spitzer) SAFETY GAS COCKS. U. S. 2,754,896 (1956) July 17.

Hollman, P. I. (assigned to Geo. D. Roper Corp.) GAS BURNER IGNITION SYSTEM. U. S. 2,751,976 (1956) June 26.

Loeber, J. A. (assigned to Minneapolis-Honeywell Regulator Co.) BURNER SAFETY CONTROL APPARATUS. U. S. 2,751,972 (1956) June 26.

Meusy, E. E. (assigned to Milwaukee Gas Specialty Co.) ELECTRIC IGNITER. U. S. 2,751,973 (1956) June 26.

Ray, W. A. (assigned to General Controls Co.) GAS-BURNER CONTROL SYSTEM. U. S. 2,753,931 (1956) July 10.

Cookers

Chambers, J. E. and Phares, T. E. (assigned to Chambers Corp.) GAS STOVE. U. S. 2,755,791 (1956) July 24.

Pappas, P. M. COMBINATION GAS AND ELECTRICALLY HEATED FRYER. U. S. 2,756,321 (1956) July 24.

Webber, O. T. (assigned to Legion Utensils Co.) MULTIPURPOSE COOKER. U. S. 2,755,795 (1956) July 24.

Gas-Electric Cooking

Rapson, I. J. GAS VS ELECTRIC SURFACE COOKING. *Gas Age*, 117, 22-24, 55, 56 (1956) June 14.

Michigan Consolidated Gas in a program demonstrates gas versus electric surface cooking, and compares the initial cost, the operating cost, the maintenance-service and the performance of electric appliances. Cleanliness, saving of heat and low initial cost was pointed out on all the tests made on gas appliances and proves that the G. E. claim is only an advertising program for publicity.

G. Kunst

Heat Load

Brisken, W. R. and Reque, S. G. HEAT LOAD CALCULATIONS BY THERMAL RESPONSE. *Heatng, Pipg and Air Condg*, 28, 143-50 (1956) July.

A new method of making heat load calculations is presented. The method starts out from electrical analog representation of the problem and makes it possible to solve even complicated problems without using analog computers. Instead of using artificial design conditions, this thermal response method punches business machine cards with actual weather data as recorded by the U. S. Weather Bureau; deter-

mines thermal response factors, and uses these factors to calculate loads by hand, by a desk calculator or a digital computer. Samples are presented to demonstrate some of the diversified calculations possible with this method. A new application method based on thermal response is developed. Authors' Abstract

Heat Pump

Robey, T. L. LET'S LOOK AT THE HEAT PUMP. *Gas*, 32, 74, 76, 78 (1956) May.

This article describes the operating principles of the heat pump and considers its limitations. The reasoning behind the electric utilities' support of the heat pump is explained, and the work being done under the PAR plan of the American Gas Association to provide a gas-fired answer to this competition is outlined.

R. F. Bukacek

Incineration

James, G. GAS INCINERATION IS A GOOD STORY. *Gas Age*, 117, 34, 62 (1956) February 9.

The gas domestic incinerator has the capacity for disposing of food wastes, papers, and other combustible refuse speedily, easily, economically, and safely. Whether on an individual or community-wide basis, such as Lincolnwood, Illinois, the gas-fired domestic incinerator is becoming a desired and indispensable household appliance. S. Close

Schwank Burners

"SCHWANK" RADIANT HEATING UNITS FOR INDUSTRIAL PROCESS APPLICATIONS. *Ind. Gas* (British), 29, 332-334 (1956) July.

Gas Council Report 601/55 is summarized, in which nearly a thousand on-off cycles were made in fifteen weeks on burners in various positions. The tests showed lambent flame above the surface, some cracking of tiles, flashback with surface temperatures above 850° C., and some need for greater primary aeration.

R. T. Ellington

Space Heaters

Buckley, M. C. OIL BURNING FLOOR FURNACE. U. S. 2,750,935 (1956) June 19.

Keeley, K. V. SPACE HEATER FOR USE ON OPEN GAS BURNER. U. S. 2,755,793 (1956) July 24.

Van Hook, C. J. (assigned to Jet-Heet, Inc.) LIQUID HEATING AND CIRCULATING SYSTEMS. U. S. 2,755,792 (1956) July 24.

Wendell, S. I. (assigned to Stewart-Warner, Corp.) SEALED HEATER VENTING SYSTEM. U. S. 2,755,794 (1956) July 24.

3. COMBUSTION AND INDUSTRIAL FURNACES

Coal Costs

Tobey, J. E. THE ECONOMICS OF COAL BUYING, *Coal-Heat* 71, 6, 8 (1956) May.

Combustion equipment makers and utility engineers have increased the capability of boiler units and widened the fuel range, but this does not eliminate the need for coal preparation and selection. Electric utility station methods of accounting usually do not reveal the incremental costs of burning different coals, which may be quite different from the cents-per-million Btu costs. Factors such as fixed charges on standby equipment; power replacement cost for boiler outage or reduced capacity; operation and maintenance cost of increased coal handling, pulverizing, corrosion, tube and wall fouling, soot blowing and ash handling must be considered for a true comparison of different coals.

O. P. Brysch

Controlled Atmospheres

Schwalm, D. J. CONTROL OF CONTROLLED ATMOSPHERES. *Metal Progress*, 70, 99-102 (1956) July.

Measurement of the carburizing potential of furnace atmospheres is more accurate if infrared analysis of carbon dioxide is used instead of dew point determination. Author's Abstract

Cylinder Accident

Boyer, R. L. AN EXPLOSION THAT SHOULDN'T HAVE HAPPENED—BUT DID. *Gas*, 32, 184, 187 (1956) May.

The substitution of oxygen for nitrogen in a laboratory test procedure was the cause of an explosion in the laboratory of the Cooper-Bessemer Corp., Mt. Vernon, Ohio. The reason for the cylinder mix-up and suggested methods for preventing similar occurences are presented and discussed. H. A. Dirksen

Flash Drying

Corder, S. E., Morris, C. O., and Atherton, G. H. SUSPENSION-DRYING OF SAWDUST. *Mech. Eng.*, 78, 627-29 (1956) July.

Flash drying is an important industrial gas application. Experimental data are presented for sawdust drying. R. T. Ellington

Gas Combustion

Mekler, L. A., and Ungar, E. E. NOMOGRAPH FOR COMBUSTION CALCULATIONS. *Petrol. Refiner*, 35, 157-60 (1956) June.

A nomograph is presented which may be used to carry out combustion calculations with Orsat analysis data. The heating value calculated for methane by use of the nomograph is nine percent in error for methane. R. T. Ellington

Power Production

McClure, J. B. and Mellor, A. G. ELECTRIC-POWER GENERATION: PAST, PRESENT, AND FUTURE. *Mech. Eng.*, 78, 521-28 (1956) June.

Progress in hydroelectric, steam-electric, gas-turbine, mercury-steam generation, and future possibilities including nuclear power.

Authors' Abstract

4. CARBONIZATION AND GASIFICATION

Ash Sintering

Smith, E. J. D. THE SINTERING OF FLY-ASH. *J. Inst. Fuel* (British), 29, 253-60, June (1956)

A dilatometer apparatus has been developed and used for determining the onset of sintering and the sintering temperature of fly-ash from pulverized fuel firing and to study factors which may cause sintering. Sinter points as determined for various coals were in the range of 850° to 1010°C. The finer grades of ash were found to be effective in promoting sintering and the highest sinter points were associated with the largest particle sizes. Results show that the sinter point can be lowered by increasing the iron oxide content of an ash. Water-soluble alkalies appeared to facilitate sintering, except when present in very small amounts. In general the sinter point was found to correspond to approximately 77 percent of the ash fusion temperature in °K. E. J. Pyrcioch

Carrier Carbonization

Myhill, A. R. A SUMMARY OF THE CARRIER GAS PROCESS. *Gas Times* (British), 87, 421-424, June 22 (1956).

This modified process for coal carbonization, also known as the Rochdale process, is reviewed in light of the experience and results obtained in several commercial installations. The process is based on the injection of a carrier gas rather than steam as normally practiced into the base of the retort. In some cases it was possible to double the carbonization rate with only a small decrease in thermal efficiency. For economic reasons, the process is not suitable for all installations. E. J. Pyrcioch

Coke Ovens

Gaskill, M. S. THE COLLIN COKE OVEN. *Gas World* (British) 143, Suppl. 115-18, 120 (1956) June 2.

The F. J. Collin AG coke oven, now constructed in the U.K. by West's Gas Improvement Company, Ltd., is described and illustrated. The "full stream reversing" system of combustion is used, wherein rich or lean gas-firing may be used. Combustion continues in each individual wall in "hairpin" flues, burning upward from base, and on reversal, burning downward from top of flue. The preheated gas and air are provided from separate lines of regenerators below the flues, one line connected with the base of flues by the nozzles and the other connected with the top of flues by the "hairpin" leg. The Collin coke dry-quenching system is also described. O. P. Brysch

Fluidized Coking

Nelson, K. J. (assigned to Esso Research and Engineering Co.) PROCESS OF CARBONIZING COAL. U. S. 2,750,330 (1956) June 12.

Fresh agglomerating carbonaceous solids are mixed in an injector-type transfer line with hot "dry" (char) solids, heated thereby and conveyed, in the fluidized state, to a processing vessel where the mixture enters a dense-fluidized zone at themperatures above the plastic temperatur. Volatile products are recovered and hot finished char overflows, in part to enter an oxidation zone to provide heat.

O. P. Brysch

Petrographic Blending

Burstlein, E. M. (assigned to Societe des Acieries de Longwy, S. A.) PROCESS FOR CARBONIZING COALS HAVING A HIGH VOLATILE MATTER CONTENT. U. S. 2,752,293 (1956) June 26.

Non-coking, long-flame high volatile coals are converted into metallurgical coke by separation and purification of the constituents, converting the durain to a char, which is reblended with clarain and vitrain in optimum proportions and the blend subjected to usual high-temperature carbonization. The raw coal separation is achieved by size-grading, which removes the usually larger (because harder) particles of durain; all constituents may be separately cleaned of mineral matter by flotation, and impurities, middlings and fusain removed before blending. O. P. Brysch

Synthesis Gas

Donath, E. E. (assigned to Koppers Co., Inc.) GASIFICATION OF FUELS. U. S. 2,751,287 (1956) June 19.

Synthesis gas produced by the gasification of pulverized coal with oxygen and steam while still at an elevated temperature is passed through a moving coal bed with additional steam partically gasifying the moving coal. The ungasified residue is suitable for use as fuel in standard water-gas generators. E. J. Pyrcioch

Eastman, D. SYNTHESIS GAS BY PARTIAL OXIDATION. *Ind. Eng. Chem.*, 48, 1118-22 (1956) July.

The exothermic reaction of methane and oxygen was studied as early as 1933 by Padovani who carried out the reaction at atmospheric pressure in the presence of a nickel catalyst. This same process was developed on a commercial scale by Schiller, Bartholome, and Koch at Opau in Germany. In the Scholler, Bartholome, and Koch process methane and oxygen were premixed and fed to a reactor through small openings in a refractory burner block, using feed velocities above the rate of flame propagation. As in Padovani's work, a nickel catalyst was used and the pressure was near atmospheric. Following World War II, work was undertaken by Hydrocarbon Research on a pressurized version of this process. As in the work of Schiller, Bartholome, and Koch the natural gas and oxygen were premixed and preheated at velocities above the rate of flame propagation. The reactor itself was internally insulated and packed with a catalyst. The Texas Co. undertook work on a noncatalytic process using a specially designed burner which permitted all the mixing to be done within the reaction zone. This process was first developed to use natural gas as a fuel but was later applied to light oil and to heavy bunker-type fuel oils. The first application of this process was at The Texas Co. Laboratory in Montebello, Calif., where from 1946 through 1954 it was used in a routine manner to provide synthesis gas for a pilot unit on a modification of the Fischer-Tropsch process. Author's Abstract

Newman, L. L. and McGee, J. P. OXYGEN GASIFICATION OF COAL. *Ind. Eng. Chem.*, 48, 1112-17 (1956) July.

To supplement the increasing demands for natural gas and to supply synthesis gas for the production of chemicals, it will be necessary in the future to use coal to provide manufactured gas. It is expected that by 1965 conditions will allow for economic gasification of coal. The lowering of the cost of gas from coal depends on solution of several major processing problems. The recent research and development work of the Bureau of Mines, the Texaco Development Corp. and the Institute of Gas Technology toward solving some of these problems relating to the gasification step are discussed. It is generally agreed that the relative amounts of oxygen, steam and coal are the major process variables, operating pressure being of less significance. Since the cost of oxygen represents a major portion of the cost of gas production some possibilities for lowering the cost of oxygen are discussed, one of which is the method suggested by I.G.T. for utilizing the temperature and pressure of the gas leaving the generator by expanding it through a gas turbine to meet the power requirements for oxygen production and compression. Gas treatment processes, such as purification and synthesis to methane and oil, have attained a considerable degree of development. The kinetics of the gasification reactions, to serve as a basis for future design of equipment, require additional research for a better understanding of the rates of reaction. E. J. Pyrcioch

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Compression

Hinton, A. E. AUTOMOTIVE IGNITION SYSTEM WORKS ON GAS-COMPRESSOR ENGINES. *Oil Gas J.*, 54, 166, 168 (1956) May 21.

This article considers the general problem of ignition systems for gas engines and describes the successful adaptation of a standard automotive ignition system to this service made by Texas Gas Transmission Corp. R. F. Bukacek

Kenworthy, C. S. SUPERCHARGING BY TUNING ENGINE EXHAUST AND INTAKE IS FEASIBLE. *Oil Gas J.*, 54, 148-52 (1956) May 21.

Work is reported by Natural Gas Pipeline Company in supercharging auxiliary engines, which normally operate at constant speed, by tuning the exhaust and intake systems. By suitable arrangement of these systems, supercharging was accomplished by synchronizing the pressure peaks and valleys with the requirement of the engine for scavenging and combustion air. R. F. Bukacek

Novasad, T. L. BETTER TEST RESULTS IN HALF THE TIME. *Oil Gas J.*, 54, 181, 183-85 (1956) May 21.

This article describes the electronic pressure indicator developed by TGT. This machine differs from the MIT indicator principally in that a strain gage pressure transducer is used instead of springs. This permits greater flexibility and the use of balancing potentiometer for recording pressures in compressor cylinders or in pipelines. This unit has a built-in tachometer. R. F. Bukacek

Condensate Removal

Rifenburgh, A. W. LIQUID REMOVAL MAINTAINS LIFE EFFICIENCY OF GAS LINES. *Pipe Line News*, 28, 30-32, 96 (1956) April.

The Mississippi River Fuel Corp. has definitely proven that removal of condensable components from gas prior to transmission coupled with adequate line cleaning, will result in maintaining a constant high throughput efficiency for the lines. B. E. Eakin

Contracts

Sue, J. O. WHAT'S HAPPENING TO GAS CONTRACTS? *Petrol. Refiner*, 35, 151 (1956) April.

Some of the factors entering into the preparation of a gas contract are analyzed in this article. B. E. Eakin

Dehydration

Kohl, A. L. and Riesenfeld, F. C. CONDITIONING GAS FOR TRANSMISSION. *Pipe Line Ind.*, 5, 54-55 (1956) May.

The use of new high-capacity solid adsorbents and higher glycol concentrations indicate improvements in the dehydration of natural gas. Increased automation will further improve conditioning processes. B. E. Eakin

Drilling

Wardroup, W. R. and Cannon, G. E. PENETRATION RATE MAY HINGE ON PROPER SELECTION OF BIT. *Drilling*, 17, 113, 186-7 (1956) May.

The average footage per rig year in the United States has increased from 35,369 feet in 1950 to 45,200 feet in 1954. However, this could be upped considerably by a careful bit-selection program, and the application of new air and gas drilling techniques. Examples are given of increased penetration rates achieved through proper bit-selection. B. E. Eakin

DRILLING BOOM IN THE PELICAN STATE. *Drilling*, 17, 122-3 (1956) May.

Drilling activity in Southern Louisiana has increased very rapidly in the last few years. Principal objectives are the Wilcox, Oligocene, and Miocene Trends. Some of the Miocene wells have calculated reserves of 800 to 1000 barrels per acre-foot. About 350 rigs are active in the area, many of them designed for marine work. B. E. Eakin

Exploration

Taylor, J. C. M. RECENT TRENDS IN OIL GEOLOGY-3 GEOCHEMICAL PROSPECTING. *Petroleum* (British), 19, 197-200 (1956) June.

The various techniques are described which have been developed for predicting the presence of petroleum reservoirs from measurement of

surface phenomena. Soil gas analysis, soil analysis, geochemical well-logging, and interpretation of results are discussed. B. E. Eakin

OWNERS TRY TO EVALUATE DEEP OIL ZONE. *Petrol. Week*, 2, 14-15 (1956) May 25. A second deep-test is being drilled by Richardson and Bass, et al, about 2 miles east of their world's deepest producing well. Total cost of the first deep well was about $2½ million, and they still are not certain where the production is from. B. E. Eakin

Gas Drive

Stone, H. L. and Crump, J. S. THE EFFECT OF GAS COMPOSITION UPON OIL RECOVERY BY GAS DRIVE. *J. Petrol. Techn.*, 8, 105-110 (1956) May.

Laboratory studies are reported on the displacement of oil from a reservoir by use of a condensing gas drive. Results obtained indicate extremely high ultimate recoveries can be realized by this technique. B. E. Eakin

Shreve, D. R., Welch, L. W., Jr. GAS DRIVE AND GRAVITY DRAINAGE ANALYSIS FOR PRESSURE MAINTENANCE OPERATIONS. *J. Petrol. Tech.*, 8, 136-43 (1956) June. This calculation method permits the prediction of gas-oil ratio, oil production rate, and cumulative oil recovery for high relief pools utilizing either gas injection or combined gas and water injection for pressure maintenance. The theory of macroscopic gravitational segregation of two fluids within a reservoir is discussed in detail. The method is illustrated by description of a typical application. B. E. Eakin

Gas Moisture

Weaver, E. R. DETERMINATION OF WATER IN NATURAL GAS BY THE MEASUREMENT OF ELECTROLYTIC CONDUCTIVITY. Amer. Gas Assoc. Opertg Sect. Paper CEP-56-3 (1956) May.

This paper describes hygrometers that depend on measured electrical resistance of hygroscopic films and the manner of their use.

R. F. Bukacek

Gas Supply – Germany

Gummert, F. PROBLEMS IN LONG-DISTANCE GAS SUPPLY IN GERMANY. Instn. Gas Eng. (British) Publ. No. 483 (1956) May; Gas J. (British), 286, 770-74 (1956) June 6; *Gas Times* (British), 87, 344, 351, 365, 367 (1956) June 15; *Gas World* (British), 143, 1460-62, 1470 (1956) June 23; *Coke and Gas* (British), 18, 210-12, 220 (1956) June.

A chart-summary of "gas flow" for Western Germany in 1954 gives details of supply and consumption of gas. Coke-oven, producer, gas works and imported gas totalling 12.8 billion N cu m (476.4 bill. SCF) are distributed directly or by gasgrid with a consumption of 12.387 bill. N cu m (461.0 bill. SCF of 458.6 Btu). Industrial users require 81.3% of the total supplies. More than half of total consumption is transmitted through the pipelines of Ruhrgas A-G. and Thyssen, who sell to industrial and city utilities. To meet the recent rate of increase (12%) in annual consumption, much technical development is taking place. Oven heating by producer gas (Wirbelkammer-process) to release rich oven gas; high-pressure oxygen gasification of non-coking coals to yield gas of about 400 Btu, (Steinkohlengas A-G.) at Dorsten; and pre-carbonization to give rich gas and char for power boilers are discussed. A successful underground storage field is operating since mid-1954 near Hanover.

O. P. Brysch

Halogen Lamp

Libby, H. T. THE HALOGEN LAMP IN GAS DISTRIBUTION. *Gas*, 32, 53-7 (1956) June.

Discussion of the use made of the halogen lamp by British Columbia Electric Company to determine gas velocity and pattern of flow in its distribution system. R. F. Bukacek

Hydrocarbon Recovery

Brosamer, R. J. and Goth, P. E., Jr. THIS PLANT'S GOING MODERN. *Petrol. Refiner*, 35, 152-4 (1956) April.

Phillips Petroleum Corp. is modernizing and expanding its Crane natural gasoline plant, in Texas. This was the first natural gasoline plant constructed by Phillips, and first started operation in 1929. The modernized plant will be capable of processing almost twice the gas volume of the early plant. B. E. Eakin

Portman, W. E. and Campbell, J. M. EFFECT OF PRESSURE, TEMPERATURE AND WELLSTREAM COMPOSITION ON THE

QUANTITY OF STABILIZED SEPARATOR FLUID T. N. 336. *J. Petrol. Tech.*, 8, 59-62 (1956) May.

A series of correlating charts are presented for use in predicting the quantity of stock-tank liquid recovered by stabilization of first-stage separator fluid. Average error between predicted and observed recovery is about 4 percent. B. E. Eakin

Prengle, H. W., Jr., Dukler, A. E., Crump, J. R. and Norris, B. E. WHAT'S THE LOWER LIMIT FOR GAS PROCESSING? *Petrol. Refiner*, 35, 141-7 (1956) April.

By utilizing skid-mounted portable units for constructing natural gasoline recovery units, it has become economical to process gas flows as low as one MMSCFD. This article presents a general classification of small gasoline plants, and lists economic factors to be considered in planning a plant. B. E. Eakin

Pyeatt, W. W. MIDGET PLANTS—AND HOW THEY GREW. *Petrol. Refiner*, 35, 145-47 (1956) June.

The Claytonville gasoline plant is actually one of three midget gasoline plants ranging in design capacity from 2 to 5 MMscfd. These plants are of the compression-refrigeration type designed to produce gasoline, LP-gas mixture and propane. The decision to build is based on the following factors: 1) Reserves; 2) composition of gas and recovery; 3) marketing; 4) plant costs and operating costs. The operation and automation of the equipment is outlined and it is stated that the flow diagram is similar to those widely known in the literature. G. Kunst

Stamm, H. E., III, McCarty, D. G., Allen, D. B. and Moore, C. S. ANALYSIS OF LOW-TEMPERATURE SEPARATION PLANTS. *J. Petrol. Techn.*, 8, 25-29 (1956) May.

A set of calculations are presented and compared with analysis of the field operation of a low-temperature separator. The agreement between calculated and actual behavior indicates this technique to be of considerable value in choosing optimum operating conditions. The need for proper interpretation of field or laboratory data is emphasized. B. E. Eakin

Weatherby, J. J. ADENA PLANT USES NO WATER. *Petrol. Refiner*, 35, 175-9 (1956) April.

Since the ambient temperature around the Adena natural gasoline plant frequently reach 20 degrees below zero, this plant was designed to use no water. Cooling towers, steam process heating, and absorption - distillation systems were replaced by dry cooling, circulating hot oil, and a refrigeration system. The results have been very favorable. B. E. Eakin

RECORD THROUGHPUT FOR TGT'S REFRIGERATED EXTRACTION PLANT. *Flow Line*, 15, 2-5 (1956) May.

Tennessee's Gabe, Kentucky, plant extracts ethane and heavier hydrocarbons from the natural gas pipeline stream. The plant is designed to process over 925 MMCF gas per day, and will recover up to 380,000 gallons of liquid product per day. B. E. Eakin

Leakage Survey

Thomas, E. R. GAS LEAK SURVEY BY MEANS OF A MOBILE SURVEY UNIT. Amer. Gas Assoc. Opertg. Sec. Paper DMC-56-7 (1956) May 7-10.

A commercially available infra-red methane analyzer is mounted in a ranch-style vehicle and as it is driven along the route of a gas main continuously monitors the methane content of the air approximately 2″ above the ground by means of a flexible tube. Cost of the equipment exclusive of the car is approximately $2500. A patent application has been made covering the method and equipment for making this type of survey. R. R. Amrine

Liquid Gas by Tanker

Crecca, J. D., Jr. LIQUID GAS: AN INVESTIGATION. *Gas J.* (British), 286, 813-14, 825, 828, 829, June 13; 900-02, June 20; 959, 60, 62, June 27; 287, 50, July 4; 104-7, July 11; 174, 175, 177 (1956) July 18.

A preliminary technical and economic evaluation of commercial storage and ocean shipping of liquefied natural gas is presented. The flexibility and cheapness of sea transportation offers advantages perhaps exceeding those of pipelines in getting Texas gas to seaboard domestic and chemical markets. Venezuelan gas for the U. S. and Middle East gas for England may have even greater advantages. Bulk oil cargo

tankers of World War II, the T2-SE-A1 tanker, are projected for conversion, to obtain operating experience. Liquefaction costs, gas purification, and proper insulation and metals must be considered: The third section gives some review of the state of commercial development, especially the Cleveland (East Ohio Gas Co.) and the W. L. Morrison method. The fourth part deals with features of ship design in the modified T2-SE-A1 tanker. Stainless steel (18-8) rectangular tanks are substituted for 10 oil tanks (the ship also carries 9620 l. tons of oil cargo). These are lined inside with 12-in. Styrofoam-balsa wood insulation and provide 160,000 cu ft cargo space for liquid methane (1916 net tons, oc 96 mill. cu ft gas). These tanks are set upon a new floor, (also insulated) five feet above the bottom shell, leaving the space below for an additional 9000 bbl of cargo oil. Details of metal-properties, welding, insulation, methane loading piping and pump, and inert gas blanket system are discussed. The three groups of low temperature processes—(1) vaporization of a liquid, (2) Joule-Thompson effect on gas; (3) expansion of gas in doing external work—and their applications are reviewed, and compared with the author's "high pressure methane-nitrogen cycle." Part V gives a fiscal analysis of the proposed system, based upon J. W. Carrol's 1951 report on Philadelphia gas demand. Costs per therm to transport methane from Galveston and Venezuela to Philadelphia (and Southampton), by American ship and foreign ship, bunker C fuel and methane fuel are tabulated. For 15,960 million CF/year, initial investment on ship and shore facilities of $55,062,400, the overall cost of operation is $3,762,530 or $0.0239/therm. Well head cost of $0.0080/therm would give total delivered cost of gas at Philadelphia of $0.319/MCF, as compared to city gate gas price of Middle Atlantic region of $0.34 in 1955. The costs also could be reduced by high pressure (above 60 psi) input gas at shore plant, presence of ethane, which is easier to liquefy and sale of refrigeration at regasification point. O. P. Brysch

Metering

Gilmore, E. R. HOW TO CHECK METER PERFORMANCE WITH A DIFFERENTIAL GAGE. *Gas*, 32, 49-52 (1956) June.

A displacement gas meter can be operating improperly even though it is in correct proof. A differential gage, used properly, can spot the meters that are in need of repairs. This article tells how meters can be accurately checked. Author's Abstract

Calif. Nat. Gasoline Assoc. TENTATIVE PROCEDURE FOR THE MEASUREMENT OF NATURAL GAS WITH ORIFICE METERS.

Bull. TS-561, Los Angeles, CNGA, April (1956). This bulletin is a revision CNGA Bulletin TS 358 and TS 402 which was made to conform them to the New American Gas Association. Gas Measurement Committee Report No. 3.

R. F. Bukacek

Pogontcheff, R. Y. CONTINUOUSLY INTEGRATED FLOW METER PROVIDES ACCURATE GAS MEASUREMENT. *Gas*, 32, 58-69 (1956) June.

This article reports tests conducted by Shell Oil Company which indicate that for rapidly varying flow rates the use of a continuously integrating flow meter is more accurate than the conventional methods. The use of increased chart rotation speed is also indicated to improve the conventional use of recording charts.

R. F. Bukacek

Weingard, A. E. (assigned to American Meter Co. Inc.) GAS METER DIAPHRAGM AND MOUNTING. U. S. 2,750,799 (1956) June 19.

Offshore Operations

Aldridge, C. PLANNING THE OFFSHORE LINE. *Pipe Line Ind.*, 5; 39-41 (1956) May. *Oil Gas J.*, 54, 174-79 (1956) June 18.

Magnolia Petroleum Co. has recently completed a 48-mile 12¾-inch diameter offshore line to transport 12,000 barrels of oil per day and 10,500 MCF of gas from their Block 126 to the Louisiana coast. The line will operate initially under two-phase flow at 1000 psi, and when sufficient production is available, it will be converted to oil exclusively, with gas to be carried through another line. B. E. Eakin

Nelson, D. O. "QUEEN MARY" DRILLS OFFSHORE ANTICLINE AT SAFANIYA FIELD. *Drilling*, 17, 104-5 (1956) May.

A step by step account of drilling operations, problems encountered and their solution, taken from the drilling logs of Aramco's Barge 136, the "Queen Mary". Author's Abstract

FROM RIG TO RIG BY AIR: THE GULF COAST INLAND BARGES. *Drilling*, 17, 125, 138-141 (1956) May.

The author of this article takes the reader along on an inspection trip of some of the marine drilling rigs along the Gulf Coast. The use of seaplanes has greatly facilitated these offshore and swamp-land operations.

B. E. Eakin

Pipelines

Harrington, R. L. RADIOGRAPHIC INSPECTION OF 1100-MILE PIPELINE. *Ind. Photogr.*, 5, 22-23, June (1956).

Gamma-ray weld inspection, which involves the use of a capsule radioactive material, proved the answer to the problem of weld inspection on a line in Saudi Arabia where lack of power ruled out the normal x-ray method.

G. G. Wilson

Reed, P. AMERICAN LOUISIANA LINE TO TOUCH OFF A HALF-BILLION-DOLLAR GAS EXPANSION. *Oil Gas J.*, 54, 156-9 (1956) May 21.

This article briefly describes the general factors of the American Louisiana Pipe Line, its equipment, pipeline, supply, reserves, and engineering and construction. R. F. Bukacek

AUTOMATIC PRESSURE BUTT-WELDING OF HIGH PRESSURE PIPELINES. *Petroleum* (British), 19, 217-18 (1956) June.

The Burton process for automatic butt-welding of pipe to pipe or flanges or tube turns is described. The technique is completely automatic, and is being developed for commercial use.

B. E. Eakin

Prince, C. A. (assigned to The Dow Chemical Co.) METHOD OF CLEANING THE INSIDE OF PIPE. U. S. 2,745,231 (1956) May 15.

This patent relates to the use of abrasive-laden liquid in conjunction with a rigid sphere to clean the interior of pipe. The sphere has a slightly smaller diameter than the pipe and serves to direct a gel and the abrasive laden liquid against the scale in the pipe as it moves through the pipe. G. G. Wilson

Pipeline Flow

Schomaker, J. F. and Hanna, L. E. HOW TO WORK THE REVISED PANHANDLE FORMULA. *Petrol. Eng.*, 8, D47-50 (1956) June.

Part 2 of a series, this article gives tables of factors useful in applying the formula, and example problems illustrating the use of the factors in design calculations. (See also *Gas Abs* 12, 164 (1956) September)

R. F. Bukacek

Smith, R. V., Miller, J. S., and Ferguson, J. W. FLOW OF NATURAL GAS THROUGH EXPERIMENTAL PIPE LINES AND TRANSMISSION LINES. U. S. Bur. Mines Monograph 9 (1956).

This monograph reports primarily the results of tests conducted by the Bureau of Mines with the American Gas Association on small diameter pipelines at Cliffside, Texas, and La Goleta, California. The tests verified Nikuradse's smooth and rough pipe laws for turbulent flow. Foreign materials, both solid and liquids, within the pipe were found to have an appreciable effect on pressure drop. The transition between smooth and rough pipe flows was found non-conformable to any simple correlation, and not in agreement with the Colebrook equation. R. F. Bukacek

Production

Breedlove, R. L. THAT CRANE TREND. *Oil Gas J.*, 54, 103-106 (1956) June 25.

The Crane Trend, opened in 1951 and producing from 155 commercial gas wells, is a reef-like deposition at about 5800 feet in the lower Pettet limestone, running SE to NW for 45 miles from Louisiana into Texas, west of Shreveport. The producing limestone is composed of variable sizes of oolites and shells, with porous streaks of 2 to 20 feet at any level of its thickness. At the Louisiana end, open flows run from 30 to 78 million CF/day, with a peak well (Latex 1 Haven) giving 210 million cf plus 72 bbl of distillate, at 2600-2700 psi rock pressures. A three-forked continuation of the bed develops in the Texas end, with similar pressures and gas yields, but averaging higher distillate yields in the North. Diagrams and sections are given. O. P. Brysch

Recycling

Carter, J. J. TEXAS-SIZE CYCLING OPERATION. *Oil Gas J.*, 54, 224-5, 227-31 (1956) June 18.

A description of the cycling operations in the Katy Field near Houston, Texas. This field is one of the largest gas-condensate reserves in the country, and the operation is of considerable magnitude. R. F. Bukacek

Regulator Stations

Schuldt, J. F. REGULATOR STATION DESIGN AND VENTILATION. *Amer. Gas J.*, 183, 16-20 (1956) June.

Several provisions in this section can be used as a guide to the design of regulators and a careful consideration has been given to the load distribution, geographical conditions, location of vent stacks and size of the station. Same guide is given to the selection of covers used for underground structure, drainage, painting, wall seals, sound proofing, electrical facilities, cathodic protection, ventilation and safety. G. Kunst

Remote Control

Nuttall, E. D. DESIGNING SAFETY AND RELIABILITY INTO REMOTE CONTROL FACILITIES. *Gas Age*, 117, 22-25 (1956) May 31.

Some of the hazards to operation of remote control systems are discussed. The type of problem discussed have to do primarily with proper attention to the nature of the equipment employed and factors which may interfere with its proper operation. R. F. Bukacek

Reservoir Engineering

Bucker, H. P., Jr., Felsenthal, M. A SIMPLIFIED PORE SIZE DISTRIBUTION APPARATUS. (Techn. Note 329) *J. Petrol. Tech.*, 8, 65-66 (1956) April.

In the intensive analysis of core samples from oil reservoirs, there is a recognized need for pore size distribution data. A simplified apparatus is described which can be used to obtain this pore data. B. E. Eakin

Howard, D. S., Jr. and Rachford, H. H., Jr. COMPARISON OF PRESSURE DISTRIBUTIONS DURING DEPLETION OF TILTED AND HORIZONTAL AQUIFERS. *J. Petrol. Tech.* (*AIME Petrol.* Trans. T. P. 4232) 8, 92-98 (1956) April.

In the withdrawal of fluids from tilted aquifers it is of value to be able to predict pressure patterns during the course of the pressure decline. As an example of this, in the displacement of fluids from oil reservoirs being produced by water-drive, prediction of the reservoir pressure is an important factor in fixing production rates. The three forms of the hydrostatic head corrections currently in use for tilted strata were examined. Use of the datums near or slightly above the midpoint of the inclined statum yielded predicted pressures in error by not over 7 psi. B. E. Eakin

Marx, J. W. DETERMINING GRAVITY DRAINAGE CHARACTERISTICS ON THE CENTRIFUGE. *J. Petrol. Tech.* (*AIME Petrol. Trans.* T. P. 4231), 8, 88-91 (1956) April.

A method is given for predicting the complete gravity drainage characteristics of arbitrarily long columns from centrifuge drainage measurements on reconstituted core samples. Oil residuals corresponding to hundreds of years of normal gravity depletion can be obtained in a few hours on the centrifuge. The gravity flow rate at any stage of the depletion process may be determined from the time correlation derived, and experimentally checked, in this study. Author's Abstract

Stahl, C. D. RESERVOIR ENGINEERING: DETERMINATION OF AVERAGE SATURATIONS IN LINEAR DISPLACEMENTS. *Producers Monthly*, 20, 12 (1956) June.

A method is presented for calculating the average oil saturation of a water-flooded formation. The equations for calculating average saturation, and the effect of variables on the efficiency of a flood at break-through, are discussed. B. E. Eakin

Underground Storage

DEEPEST, HIGHEST-PRESSURE GAS STORAGE. *Oil Gas J.*, 57, 60 (1956) June 4.

Lone Star Gas Co. has started work to convert a gas-distillate field in East Texas into the world's deepest and highest-pressure underground gas storage project to hold 35 billion CF at 3200 psi in the Bacon and Rodessa limestones. The idea behind the project was the

basis of Paper GSTS-56-2 at the American Gas Assoc. Gas Supply Conf., May 10-11, Chicago. Bureau of Mines engineers concluded that more oil might be recovered from a depleted reservoir by a storage operation than via conventional gas cycling. It was suggested that this operation might recover almost as much oil as primary production methods. G. Kunst

WORLD'S LARGEST UNDERGROUND GAS STORAGE INSTALLATION. *World Petrol.*, 27, 56-57, 83-84 (1956) June.

The Oakford, Pennsylvania, gas storage pool has an ultimate capacity of 105 billion cubic feet of gas in storage, of which 60 billion is available for winter loads. This field, with associated smaller fields, is helping to solve the problem of natural gas supply in a varying and growing East Coast market. B. E. Eakin

Well Practise

COUNTRY'S FIRST TRIPLE WELL NOW BEING TESTED. *Petrol. Week*, 2, 10-11 (1956) June 8.

The first triple completion utilizing a single well-head control is described with pictures and a schematic drawing. The method permits separate control of production from three sands simultaneously. B. E. Eakin

Huitt, J. L. FLUID FLOW IN SIMULATED FRACTURES. *Amer. Inst. Chem. Eng. J.*, 2, 259-64 (1956) June.

The literature data cited in this paper together with the new data reported in this study show that fluid flow in fractures can be treated similarly to fluid flow in circular conducts and that satisfactory friction-factor correlations permitting engineering flow calculations for fractured systems result. The correlations and resulting equations are presented. B. E. Eakin

Clark, E. H., Jr. HIGH PRESSURES DEVELOPED WHEN RUNNING PIPE, CASING. *Drilling*, 17, 115-6, 176, 178 (1956) May.

Under certain conditions high pressures can be developed in the well when running pipe or casing. These pressures can cause fracturing, sloughing of loose shales, and result in lost circulation. How these pressures are developed, and methods for preventing their occurrence, are discussed. B. E. Eakin

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Cracking Plant

FORMOSA PLANT EXPANDS. *Oil Gas J.*, 54, 76 (1956) June 4.

A new Thermofor catalytic cracker has just been put on stream at the Nationalist Chinese refinery on Formosa. A catformer was built last year and alkylation, hydrogen treating and aromatics extraction units are planned for the near future. Private financial assistance was obtained from American oil companies which will furnish Middle East crude for processing. E. B. Shultz, Jr.

Desulfurization

Noble, D. A. J. (assigned to The British Petroleum Co. Ltd.) TREATMENT OF SULFUR-CONTAINING MINERAL OILS WITH KEROSENE PEROXIDES. U. S. 2,749,282; 2,749,283 (1956) June 5.

A method for applying the "auto-fining" process to the desulfurization of cracked naphthas obtained from thermal or catalytic cracking of high-boiling petroleum distillates is disclosed. Such cracked naphthas are treated under auto-fining conditions after mixing with a petroleum fraction which contains naphthenic constituents capable of providing the necessary hydrogen and which has a boiling range such that the naphtha may be removed by distillation from the treated mixture. D. M. Mason

Noble, D. A. J. (assigned to The British Petroleum Company Ltd.) TREATMENT OF SULFUR-CONTAINING MINERAL OILS WITH KEROSENE PEROXIDES. U. S. 2,749,284 (1956) June 5.

Mineral oil fractions are heated to remove organic sulfides by reacting with an organic peroxide under conditions such that oxidation products of the sulfur compounds are formed. These oxidation products may be removed by processes such as acid washing, solvent extraction, extractive distillation, adsorption. Peroxide-containing material for the oxidation may be obtained by controlled aerial oxidation of hydrocarbons such as mineral oil fractions or sulfur-free and aromatic-free kerosene. D. M. Mason

High Octanes

Weber, G. H. HOW TO NUMBER OCTANES AFTER 100. *Oil Gas J.*, **54**, 68-70 (1956) June 4.

The respective merits of the three methods for numbering octanes above 100 are discussed.

E. B. Shultz, Jr.

Jet Fuel

Guthrie, V. B. A STANDARD JET FUEL AVAILABLE WORLD-WIDE. *Petrol. Proc.*, **11**, 83-84 (1956) June.

A fuel of uniform characteristics for all types of commercial gas-turbine-powered aircraft must be available throughout the U.S. and many other countries by 1959-60, if the oil company suppliers are to keep up with the continuing expansion in commercial aviation. For example: a jet plane on a single flight from Los Angeles to Tokyo, with stops in New York, London, and Rome, will have to be assured of a uniform fuel whenever it refuels. This is one of the five highlights of an appraisal of fuel requirements for commercial gas turbine-powered aircraft made at a session of the National Aeronautic Meeting of the Society of Automotive Engineers in New York City April 9-12. The other four: Airlines favor a kerosene-type fuel as the world-wide standard, if the price is equivalent to that for other suitable materials. The specification drawn for a universal kerosene fuel must be broad enough so as not to restrict the supply unduly. The chief technical difficulty in setting up a world-wide standard is to reconcile the difference in volatility between U.S. products and those of other countries. Special precautions will have to be followed by oil company suppliers and airline users in the storing and handling of a kerosene-type fuel to eliminate all traces of free water at the time of servicing the aircraft. Selected Extracts

JET-FUEL MARKET WILL BE KING SIZE. *Oil Gas J.*, **54**, 72 (1956) June 4.

The Texas Company has just opened a new jet-fuels laboratory at its Beacon, New York research center. Capable of testing jet fuels in full-scale combustors, this installation will study burning characteristics, combustion deposits, smoking tendencies and flame radiation. Texaco expects that domestic airlines will use 1.1 billion gallons of jet fuel per year by 1962.

E. B. Shultz, Jr.

NATO Pipelines

Shipley, J. R. NATO'S NEW 4,500-MILE PIPELINE SYSTEM. *Oil Gas J.*, **54**, 121-122-124 (1956) June 4.

A review of the problems found in planning and construction of the NATO liquid fuels pipeline. Construction has progressed and about 4,500 miles are completed to date. Despite the difficulties the system is reported to be in first-class condition. W. G. Bair

Reservoir Engineering

Meyer, H. I., Searcy, D. F. ANALOG STUDY OF WATER CONING. (Techn. Note 328) *J. Petrol. Tech.*, **8**, 61-64 (1956) April.

An analog study of the behavior of two immiscible fluids in porous media is described. The data, and an analysis of the results are presented. B. E. Eakin

Steber, J. D. and Marseen, S. S. THE DETERMINATION OF LIQUID SATURATIONS IN A POROUS MEDIUM BY A METHOD OF MATCHED REFRACTIVE INDICES. *Producers Monthly*, **20**, 48-51 (1956) April.

The experimental results reported indicate fluid saturation and saturation distribution can be determined by a system of matched refractive indices. Average deviation of the experimental data is $\pm$ 5% saturation. B. E. Eakin

Watkins, J. W., Dunning, H. N., Armstrong, F. E., Heemstra, R. J. and Hsiao, L. RADIOACTIVE ISOTOPES IN PETROLEUM-PRODUCTION RESEARCH. *Producers Monthly*, **20**, 41-47 (1956) April.

The use of radioactive isotopes is described for determining the characteristics of petroleum-productive formations that are of interest in water-injection programs. Results of experimental solid adsorption studies for synthetic detergents containing radioactive molecules are reported. B. E. Eakin

Shale Oil Refining

Crecelius, R. L., Knidschy, E. O., White, E. R., Cottingham, P. L., and Murphy, W. I. R. RECYCLE HYDROGENATED SHALE-OIL CRUDE. *Petrol. Ref.*, **35**, 171-5 (1956) June.

Crude shale oil from the gas combustion retort was hydrocracked over cobalt-molybdate cata-

lyst at 3000 psig, 889°F with high conversion to 57.6 API gravity gasoline which contained 80% saturates, 13% aromatics and 7% olefins, by volume. Similar runs on shale oil from the higher temperature entrained-solids retort produced high yields of gasoline which was somewhat higher in aromatics. In these runs very little net heavy oil was produced, catalyst deposit was less than a percent, and gas formation was 14 to 18 weight percent. In a third series of runs, 700°F end point cracking stock of about 38 API gravity was made from shale oil by hydrogenation over cobalt-molybdate at 784°F with only 2 percent gas formation. Product was 67 to 70% saturates, 26 to 31% aromatics and 0 to 5% olefins, by volume. Recycle ratios were 0.6 to 1.0. E. B. Shultz

Storage Safety

EXPLOSION-PROOFING AT THE STORAGE POINT. *Nat. Petrol. News*, 48, 110-112 (1956) June.

Extreme precaution is routine with major companies and big independents. Smaller operators can adapt the same safety measures to a smaller scale. A vapor-air mixture in which 1.3% to 6% is gasoline vapor is highly explosive under confined conditions. Smoking, naturally, can ignite this mixture; so can electrical arcs, sparks, or excessively hot apparatus. The National Electrical Code defines electrical hazards and classifies them by type and degree of danger. One code category, Class I, applies directly to bulk plants and terminals. It includes locations where "vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures." Division One-Within Class I. the code recognizes that explosive vapor-air mixtures may not always be present. But areas where conditions are normally and frequently hazardous are called Division One locations. Examples: Rooms containing pumps for volatile flammable liquids. Rooms with valves in pipe lines handling such liquids. Rooms where such liquids are transferred in individual containers. Division Two—These locations are classified as abnormally and infrequently hazardous. Examples: Outdoor areas next to loading racks or platforms, or next to above-ground tanks. Areas extend 25 ft around racks or tanks and upward 15 ft (the latter limit varies with the discretion of local inspectors). Basements, pits or depressions within 25 ft of above-ground tanks, within 25 ft and below the level of the top of underground tanks, or within 25 ft of any loading rack or platform (these specifications can all be altered by a code-enforcing authority). Storage and repair garages for tank trucks, without limitation on height above floor level.

Selected Extracts

Tank Calibrations

Jelffs, P. A. M. THE CALIBRATION OF TANKS AND TANKERS. *Petroleum* (British), 19, 191-6 (1956) June.

A lengthy description of the calibration of large oil storage tanks and tank ships. The writer recommends actual measurement instead of relying on builders plans. W. G. Bair

Vapor Yields

Grosberg, J. S. and Mapstone, G. E. VAPOR YIELDS ON FLASHING. *Petrol. Refiner*, 35, 208 (1956) April.

The equations derived in this article allow the direct calculation of the vapor yields on the flashing of an oil. This simplified procedure should prove helpful in processing calculations.

B. E. Eakin

7. ANALYTICAL METHODS AND TESTS

Combustion Analyzer

Cohn, J. G. (assigned to Baker & Co.) APPARATUS FOR THE CONTINUOUS ANALYSIS OF CONTAMINANTS IN GASES. U. S. 2,751,281 (1956) June 19.

Improvements in the catalytic combustion type of continuous analyzer are described which make it possible to extend the range of the analyzer to much lower concentrations of contaminant. From 0.0001 to 0.001% of such contaminant, for example oxygen, can be analyzed by such an improved instrument.

D. M. Mason

Distillation

Nerheim, A. G. and Dinerstein, R. A. ANALYTICAL DISTILLATION IN MINIATURE COLUMNS. *Anal. Chem.*, 28, 1029-33 (1956) June.

Performance data for miniature distillation columns are needed to select the best column and operating conditions for separating a particular sample. Columns should be evaluated

under both total reflux and actual operating conditions. Such a study has been made of typical commercially available columns. At total reflux, the Hyper-Cal column has a lower height equal to a theoretical plate than concentric-tube and spinning-band columns. The spinning-band column has the lowest holdup and pressure drop; it is more efficient when a tight band is used and rotated at the optimum speed. Reducing the pressure to 300 mm. decreases plates for all columns at moderate but not at low throughput. Studies at partial reflux reveal the importance of holdup. Although the Hyper-Cal column has more plates, the spinning-band, having lower holdup, may give a better separation of a small sample. In such cases, high reflux ratio is undesirable. Equivalent separations have been obtained in both miniature and macro Hyper-Cal columns operated under like conditions. Authors' Abstract

Diene Method

Claiborne, E. B., Davis, H. M., and Rivet, C. A., Jr. ANALYSIS OF CYCLOPENTADIENE DIMER. *Anal. Chem.*, 28, 1104-06 (1956) July.

Existing methods for cyclopentadiene analysis have been reviewed. A new analytical method utilizing the mass spectrometer is described in which cyclopentadiene dimer concentrates are depolymerized in a specially constructed cracking chamber attached to the inlet system of the mass spectrometer. The method is accurate, reproducible, rapid, and ideal for plant and product quality control in a cyclopentadiene recovery process. Authors' Abstract

Gases in Metals

Mallett, M. W. PROBLEMS OF GASES IN METALS. *Battelle Techn. Rev.*, 5, 7-12 (1956) June.

Methods of determining gases in metals and current problems due to their presence are reviewed. D. M. Mason

Hydrogen Method

Holt, B. D. DETERMINATION OF MICRO QUANTITIES OF HYDROGEN. *Anal. Chem.*, 28, 1153-57 (1956) July.

A combustion method has been developed for the determination of micro amounts of hydrogen in uranium and other materials. The water produced from the combustion of the sample in an oxygen stream is collected in a capillary trap at —78° C. The trap, a U-tube which may be swiveled upward or downward by means of semiball joints, serves also as the fixed volume leg of a constant volume manometer. The vapor pressure of the entrapped water is then measured at 100° C. A low and stable blank with an average daily standard deviation of 0.02 γ of hydrogen permits the method to be sensitive to quantities of hydrogen less than 0.1 γ. Simultaneous microdeterminations of both hydrogen and carbon can be completed within a half hour. The sample is not subjected to low pressures. Authors' Abstract

Infrared Analyzers

Savitsky, A., Woodhull, E. H. and Weber, A. P. CONTINUOUS INFRARED ANALYZERS FOR PROCESS CONTROL. *Ind. Eng. Chem.*, 48, 1047-52 (1956) June.

The advantages obtained from continuous infrared analyzers used for process control are given. A brief discussion of the principles of infrared analyses is also included. E. Mann

Iron Method

Rydell, R. G. and Rodewald, W. H. IRON IN OIL TECHNIQUE AS A CORROSION CONTROL CRITERION. *Corrosion*, 271-76t (1956) June.

A technique is described for the colorimetric determination of iron as a short term method of evaluating corrosion control at oil well heads. Complete date is given for the method along with tables of average content per month over a period of months for a number of wells. R. R. Amrine

Nickel in Catalysts

Blackwell, A. T., Daniel, A. M., and Miller, J. D. PHOTOMETRIC DETERMINATION OF NICKEL IN PETROLEUM CRACKING CATALYST. *Anal. Chem.*, 28, 1209 (1956) July.

The article describes a simple and accurate improvement of the dimethylglyoxime method for nickel in amounts up to 300 gamma per gram of sample. Stable color is obtained by control of pH, temperature, and interfering substances. No separations are necessary, and the absorbance of the nickel complex is read at 530 milli-microns in a Beckman DU spectrophotometer. The authors believe that the method might be used on a wide variety of materials. F. M. Kissinger

Silicon Purity

Keck, P. H., MacDonald, A. L. and Mellichamp, J. W. SEMIQUANTITATIVE SPECTROCHEMICAL ANALYSIS OF SILICON. *Anal. Chem.*, 28, 995-96 (1956) June.

The impurities present in high purity silicon are concentrated by vacuum distillation using high frequency induction for melting the sample. The limits of spectro-chemical detection have been extended from 1 p.p.m. to approximately 0.01 p.p.m. for several elements.

R. R. Amrine

8. GENERAL AND PHYSICAL CHEMISTRY

Capillary Flow

Coley, F. H., Marsden, S. S., and Calhoun, J. C. A STUDY OF THE EFFECT OF WETTABILITY ON THE BEHAVIOR OF FLUIDS IN SYNTHETIC POROUS MEDIA. *Producers Monthly*, 20, 29, 32-45 (1956) June.

In this investigation it was determined that wettability is one of the primary contributing variables to the realization of consistent correlations between capillary pressure, relative permeability, and water flooding measurements. The concept of tortuosity as being a simple linear relationship with saturation is also questioned. B. E. Eakin

Miller, E. E. and Miller, R. D. PHYSICAL THEORY OF CAPILLARY FLOW PHENOMENA. *J. Appl. Physics*, 27, 324-32 (1956) April.

A mathematical relationship is derived for the phenomena of capillary flow in porous media. The resulting equations indicate a hysteresis effect in their dependence upon the liquid-gas differential pressure. The equation are presented in a reduced form permitting comparison of behavior between similar systems of varying physical dimensions. B. E. Eakin

Von Engelhardt, W. and Tunn, W. L. M. THE FLOW OF FLUIDS THROUGH SANDSTONES. *Producers Monthly*, 20, 38-43 (1956) May.

This investigation indicates that the Darcy equation represents the flow of air, carbon tetrachloride and cyclohexane, but deviates for benzene, water, and salt solutions. Water and salt solutions flow more slowly than would be predicted by Darcy's relationship. It is proposed that the interaction of water and electrolyte solutions with the pore walls causes this deviation. B. E. Eakin

Catalysts

Ipatieff, V. N. and Monroe, G. S. (assigned to Universal Oil Products Co.) PRODUCTION OF HYDROGEN. U. S. 2,750,261 (1956) June 12.

A hydrocarbon reforming catalyst is described which is composed of nickel oxide, copper oxide and silica. Low temperature conversions are claimed in the range 840 to 1200°F but throughput is very low. W. G. Bair

Michael, W. UEBER DIE HERSTELLUNG VON HOCHWERTIGEN BENZINEN UND VON OLEFINEN MITTELS SYNTHESE AUS KOHLENOXID-WASSERSTOFF-GEMISCHEN. (THE PRODUCTION OF HIGH-GRADE GASOLINE AND OLEFINS BY SYNTHESIS FROM CARBONMONOXID-HYDROGEN MIXTURES. *Brennstoff-Chemie* (German), 37, 171-75 (1956) June 13.

A process was developed before the second world war by BASF in order to overcome the difficulties which arise in the synthesis of hydrocarbons from carbon monoxide-hydrogen mixtures with iron as a catalyst, high temperatures and medium pressures in order to produce an antiknock gasoline. Sintered iron-catalysts were used at high relative velocities between gas and catalyst, and convective heat transfer was used by circulating the gas of the reaction. A modified procedure was developed during the war with high activity iron catalysts in a fluid phase for the production of olefins with a larger chain for subsequent chemical treatment. By a modification of the sintering method iron catalysts could be obtained, which are applicable for the synthesis of high-melting paraffins at relative low temperatures in a tube furnace. G. Kunst

Gas Solubility

Crawford, P. B. WATER TECHNOLOGY: VOLATILITY OF DISSOLVED GASES IN WATER. *Producers Monthly*, 20, 20 (1956), June.

Application of Henry's law to solution of gases in water is illustrated with examples. Data on a number of common gases is presented graphically. D. M. Mason

Hydrocarbon Equilibria

Myers, H. S. BINARY MIXTURES OF NAPHTHENES AND AROMATICS. *Ind. Eng. Chem.*, 48, 1104-1108 (1956) June.

Atmospheric pressure vapor-liquid equilibrium data for five binary mixtures of aromatic and naphthenic hydrocarbons are presented. A vapor-recirculating type equilibrium still was used to obtain the data. B. E. Eakin

Radiation Transfer

Oppenheim, A. K. RADIATION ANALYSIS BY THE NETWORK METHOD. *Amer. Soc. Mech. Eng. Trans.*, 78, 725-35 (1956) May.

Problems of net radiation transfer in enclosures involve proper accounting of all the interreflections of radiation beams. This is shown to be equivalent to the solution of electrical networks made up of conductances which are fully determined by surface-shape factors, reflectivities, and transmissivities of the system elements. The scope of the analysis is restricted to diffuse radiation within enclosures consisting of gray surfaces and containing gray gases, but the method is applicable to heat transfer as well as to illumination problems, and it can be extended to include other modes of heat transfer and energy transformation.

Author's Abstract

9. ORGANIC CHEMISTRY

Butadiene

Fetchin, J. (assigned to Phillips Petroleum Co.) PROCESS FOR SEPARATION OF C_4 HYDROCARBONS AND SOLVENT THEREFOR. U. S. 2,750,435 (1956) June 12.

This invention relates to methods for separating and recovering pure individual C_4 hydrocarbons from gaseous and/or liquid mixtures. Also covered is a two-stage process for dehydrogenation of n-butane to butadiene, including recovery of the butadiene in a substantially pure state. A new improved selective absorbent, liquid polydimethyl siloxane in C_8-C_{10} hydrocarbons, is also described in detail. B. E. Eakin

Coal Chemicals

Herbert, W. and Tramm, H. FISCHER-TROPSCH-SYNTHESE IN SUEDAFRIKA (FISCHER-TROPSCH SYNTHESIS IN SOUTH AFRICA). *Erdoelund Kohle* (German), 9, 363-77 (1956) June.

Because of high transportation costs of oil and the availability of coal a Fischer-Tropsch plant was erected by the South African Coal, Oil and Gas Corp. in order to use coal as a source of liquid fuel, but also for the purpose of starting an organic-chemical industry. A table of chemicals to be made in this plant is included. Details of the plant, the operation and the recovery systems are given. G. Kunst

Epoxides

Sherwood, P. W. EPOXIDES FROM PETROLEUM HYDROCARBONS. *Petroleum* (British), 19, 203-207 (1956) June.

This is the fourth in a series on petroleum chemical processes. The outstanding position of epoxides is largely due to high output of ethylene oxide, about 700 million pounds in 1954 in the U. S. Hydrolysis to the corresponding glycol is the main outlet for epoxides, but conversion to acrylonitrile and ethanolamines is important. Production of ethylene oxide via chlorohydrination and direct catalytic oxidation is discussed. In addition, propylene oxide and styrene oxide production is described.

E. B. Shultz, Jr.

Hydrocarbon Recovery

Schmidt, K. H. CRACKEN VON KOHLENWASSERSTOFFEN ZU AETHYLEN UND BENZOL. II. GEWINNUNG VON BENZOL AUS KOHLENWASSERSTOFFEN. (THE CRACKING OF HYDROCARBONS TO ETHYLENE AND BENZENE. II. THE PRODUCTION OF BENZENE FROM HYDROCARBONS. *Brennstoff-Chemie* (German), 37, 175-82 (1956) June 13.

The production of ethylene and benzene from pure hydrocarbons was investigated, especially the influence of temperature and time on the yield. The derived equations for each case are given and the conditions for best yields are properly illustrated. G. Kunst

Synthetic Rubber

Resen, L. BUTADIENE, SYNTHETIC RUBBER PACE EXPANSION. *Oil Gas J.*, 54, 163-6 (1956) June 18.

The butadiene industry in the Texas-Louisiana

area has been expanding rapidly and this article describes the new installations that will raise annual capacity by 343,000 short tons.

E. B. Shultz

10. CHEMICAL ENGINEERING

Distillation

Jackson, R. F. and Pigford, R. L. RATE OF APPROACH TO STEADY-STATE BY DISTILLATION COLUMN. *Ind. Eng. Chem.*, 48, 1020-6 (1956) June.

Transient changes and rate of approach to steady-state within a countercurrent distillation column are of practical interest during startup of a continuous column, during batch distillation cycle and cases where the rate of response of the column to small changes in external conditions needs to be known. A study of the first case was made with the hope to shed some light on the other two. The mathematical method of analysis is described; also an analysis of the material balance, the numerical solution of transient equation, a discussion of the computer results and an example calculation is given.

G. Kunst

Fluid Flow

Hutchinson, F. W. POWER REQUIREMENT FOR STREAMLINE FLUID FLOW. *Air Cond., Heatg. and Ventilg.*, 53, 74-78 (1956) June.

The kinetic energy of streamline flow differs from values obtained through equations which apply to turbulent flow. Engineers working in the range of low Reynolds numbers can avoid underpowering equipment by proper attention to the factors analyzed in this article. A discussion of the evaluation of the kinetic energy in laminar flow velocity distribution is included. The difficulty in establishing a procedure for analysis of turbulent flow is described in detail.

G. Kunst

Fractionator Control

Berger, D. E. and Short, G. R. SAMPLING AND CONTROL CHARACTERISTICS OF ANALYSIS-CONTROLLED PENTANE FRACTIONATOR. *Ind. Eng. Chem.*, 48, 1027-30 (1956) June.

This article is concerned with the application of the process refractometer to the separation of isopentane from normal pentane with emphasis on sampling point considerations and on the process control behavior of the fractionator-refractometer system. A description and operation of the column, the control of the system and difficulties involved are discussed.

G. Kunst

Packed Columns

Jacobs, J. K. DESIGN PACKED COLUMNS. *Petrol. Refiner*, 35, 187-8 (1956) June.

A nomograph is presented which will facilitate packed tower design.

R. T. Ellington

Pilot Plants

Jordan, D. G. HOW TO SCALE UP PILOT PLANT DATA. *Petrol. Refiner*, 35, 129-35 June.

The author reviews a number of scale-up methods: a) New situation, but experimental data fits known design equation so only evaluation of constants is necessary, b) Experimental results are correlated by dimensional analysis techniques to form design equation. c) There may be no equation at all, and strict adherence to dynamic similitude is required.

R. T. Ellington

Payne, J. W. WHEN TO USE A PILOT PLANT. *Petrol. Refiner*, 35, 126-8 (1956) June.

To determine when a pilot plant should be used in developing new processes these questions must be answered: a) Extent of application of the process? b) How soon is process needed? c) How much is unknown? Proper analysis of these factors will show whether it is most economical to design and build the commercial plant from basic process data or go through the pilot stage.

R. T. Ellington

Thornton, D. P., Jr. WHAT TO AVOID IN SCALE-UP. *Petrol. Refiner*, 35, 136-9 (1956) June.

The author discusses a number of factors which may cause trouble in scaling up pilot plant data: side reactions, size disparities, contaminants, metallurgy, heat effects, recycle, and entrainment. He states that proper consideration of these factors has reduced Universal Oil Products practice to the use of very small pilot plants. Most of them use about 200 cc feed per hr, and the largest, one barrel per day.

R. T. Ellington

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Conveyor

Peterson, G. S. and Welsh, C. J. (assigned to Union Oil Co.) CONVEYANCE OF GRANULAR SOLIDS. U. S. 2,751,257 (1956) June 19.

The present invention comprises an improved solids conveyance process wherein the granular solids are introduced into an elongated conveyance zone, are conveyed therethrough by means of a concurrently depressuring conveyance fluid, and are maintained during conveyance in substantially compact form. The ratio of the force of the pressure gradient to the opposing gravitational force existing in the conveyance zone is called the conveyance force ratio and is given by (dp/dl over $P_s \cos \Theta$ wherein dp/dl is the pressure gradient along the length of the conveyance zone in pounds per square foot per foot, ps is the bulk density of the granular solids in pounds per cubic foot, and Θ is the angular deviation of the conveyance zone from a vertical axis. Authors' Abstract

Metering

Gehre, H. (assigned to Elster and Co.) METER FOR MEASURING THE VOLUME OF FLUIDS FLOWING IN A PIPE LINE. U. S. 2,749,752 (1956) June 12.

This patent describes a turbine type of device for metering fluids. It relates to a type of floating turbine rotor which in various operating positions frees various sizes of cross sections.
R. F. Bukacek

Nolte, C. B. PRINCIPLES AND PRACTICE OF ORIFICE METERING. *Instruments and Autom.*, 29, 716-21 (1956) April.

A general and simple treatment of orifice meters which is a useful survey of the principles and practice aspects. R. F. Bukacek

Plant Instruments

Willard, B. J. UP TO DATE ON PLANT INSTRUMENTATION? *Petrol. Refiner*, 35, 170-4 (1956) April.

The application of a process instrumentation to natural gasoline plants is outlined in this description of the Honor Rancho gasoline plant in California. Indicating, recording, and automatic control instruments are discussed.
B. E. Eakin

Specific Gravity Meters

Kretschmer, F. VON DER GASWICHTE UND WIE SIE GEMESSEN WIRD. (GAS SPECIFIC GRAVITY AND HOW TO MEASURE IT.) *Gas- u Wasserfach* (German), 97, 461-65 (1956) June 1.

This article has the purpose of comparing the different measuring devices for specific gravity used nowadays in the gas industry. The individual instruments are described and also analysed with respect to the performance and percent error in order that the user can choose the best that suits his special purpose. Also the industries are mentioned where one or the other instrument is preferred for a special reason.
G. Kunst

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Hamilton, H. L. CATHODIC PROTECTION: A COOPERATIVE ENDEAVOR. *Gas Age*, 111, 40-50 (1956) May 3.

A discussion of the importance of a cooperative approach to the solution of cathodic protection problems. After a general presentation of the subject, its practical application is illustrated with four detailed case histories of operating difficulties resulting from failure to conduct interference tests and to illustrate the benefits of a proper cooperative engineering approach to the solution of cathodic protection problems. G. G. Wilson

Ledford, R. C. SUBMARINE LINES NEED CORROSION PROTECTION. *Petrol. Eng.*, 28, D41-43, 46, June (1956).

Methods used by the Marine Gathering Co. to cathodically protect offshore pipelines in the Gulf of Mexico are presented. The installation techniques used for anodes and check stations are illustrated with diagrams and pictures.
G. G. Wilson

Riordan, M. A. CATHODIC PROTECTION REACHES UP TO COVER THE SPLASH ZONE. *World Oil*, 142, 250, 53, 56, 59, 60, June (1956).

A new approach has been developed for the

protection of the splash zone of partially submerged structures which permits the use of cathodic protection. This method, which is currently undergoing field ests, is described in detail.

G. G. Wilson

Coatings

Gartner, F. W., Jr. METALLIZING HELPS LICK GULF COAST CORROSION. *World Oil*, 142, 220, 25, June (1956).

The use of metallizing, which consists of the spray application of metal coatings, to protect off-shore well equipment in the Gulf Coast area is described. The metal most commonly used is zinc and several examples of the performance of zinc-coated structures are given. Rough comparisons of the cost of metallizing with the cost of other coating systems are included.

G. G. Wilson

Inhibitors

Poetker, R. H. and Stone, J. D. CORROSION CONTROL OF GAS-LIFT WELLS. *Oil Gas J.*, 54, 100-107 (1956) July 9.

Results indicate that a new method of squeezing inhibitor into the production formation is superior in efficiency and economy to the usual batch treatment for gas-lift wells.

Authors' Abstract

13. NEW BOOKS

(C. A. Simms, Librarian)

Control Instruments

Holzbock, W. G. INSTRUMENTS FOR MEASUREMENT AND CONTROL. New York: Reinhold Publishing Corp., 1956.

This book deals with industrial instruments commonly used for remote reading or action within the industrial plant. Its objectives are to, a) discuss the types of instruments available for measurement and control of process variables; b) act as a reference for those searching for an instrument for specific needs; and c) permit the developer of a new instrument to compare his approach with those common to the industry. A very large number of contemporary instruments are described in detail.

R. T. Ellington

High Temperatures

Campbell, J. E. (Ed.) HIGH-TEMPERATURE TECHNOLOGY. New York: John Wiley and Sons, Inc., 1956.

Highlights of research achievements in construction materials for high-temperature service are described by 35 specialists in a volume sponsored by the Electrochemical Society, Inc. After a brief introduction on problems in refractory materials, the book is comprised of three sections dealing with materials, methods of obtaining high temperatures, and temperature and property measurements. The materials reviewed in 215 pages, include metals, oxides, carbon (graphite), carbides, borides, silicides, nitrides, sulfides, and cermets, each of which has shown promise in particular applications. The methods section (96 pages) deals with the sintering process, and with modern high temperature furnaces (above 1500° C.). The latter include resistance, induction, arc, and solar furnaces, and the electronic torch. Part IV deals with modern measurements of high temperatures, and of properties, mechanical and physical, of various materials at these temperatures, such as plastic deformation, hardness, melting point, phase equilibria, vapor-pressure, thermal conductivity and expansion. Each chapter has an extensive modern bibliography, and a final 23-page author and subject index is provided.

O. P. Brysch

Pressure Measurement

Brombacher, W. G. and Lashof, T. W. BIBLIOGRAPHY AND INDEX ON DYNAMIC PRESSURE MEASUREMENT. Nat. Bur. Standards Circ. 558 (1955) February 14.

This circular contains a bibliography of 850 items on dynamic pressure measurement and, in less detail, on related subjects such as static pressure measurement and general information on the components of instruments. An index of the bibliography by both subject and author is included.

Authors' Abstract

Research Administration

Proceedings of the Ninth Annual Conference on the ADMINISTRATION OF RESEARCH. (Sept. 7-9, 1955) (103 pages) $4.00: New York: N. Y. University Press, 1956.

This report deals essentially with the research relationships between government, industry and the university on a philosophical basis. There is little of a nature which would be helpful to organizations seeking support for research.

R. T. Ellington

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Bituminous Coal Research Reports
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Monthly Bulletin and Quarterly Gazette
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Canadian Gas Journal
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Canadian Journal of Technology
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Chemical Engineering Science
Chemical Processing
Chemical Reviews
Chemical Society (London) Journal
Chemical Week
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Engineers' Digest
Erdöl und Kohle

Faraday Society. Transactions
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Gas Age
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Gas Council (British) Publications
Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association
of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins,
Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
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Mathematical Aids
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National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
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